

What is claimed is:

1. A combined vertical and release micromachining process, comprising the steps of:
  - forming a mask on a substrate;
  - substantially isotropically etching said substrate through said mask and slightly undercutting said mask;
  - conformally passivating said substrate to produce a passivation layer of selected thickness;
  - alternately etching and passivating said substrate to define a structure in said substrate;
  - controlling the timing of said etching and passivating steps to produce a structure having substantially vertical walls; and
  - thereafter altering the timing of said etching and passivating steps to deposit a passivation layer of increased thickness and to etch said substrate to completely undercut and to release said structure.
2. The process of claim 1, wherein said steps are repeated to produce a second released structure self-aligned below said first structure in said substrate.
3. The process of claim 1, wherein said steps form a first level structure, and further including the steps of:
  - vertically etching said substrate through said mask and through said first level structure to form a trench defining a second level structure;
  - applying an oxide layer to the sidewalls of said trench; and
  - anisotropically etching said trench below said sidewall oxide layer to release said second level structure.
4. The process of claim 3, wherein forming a mask includes defining said first level structure to have a first width, and wherein vertically etching said substrate through said first level structure defines said second level structure to have a second width greater than said first width by the thickness of said first level passivation layer.
5. The process of claim 4, further including electrically isolating selected

segments of said first and second structures by thermal oxidation of said structures.

6. The process of claim 5, further forming an electrical contact point on said structures.

7. The process of claim 6, further including applying an electrically conductive layer to said structures.

8. The process of claim 4, further including removing selected portions of said structures by a focused ion beam.

9. The process of claim 4, further including removing a selected portion of said structures by fully oxidizing a selected thin segment of said structure and etching away said thin segment.

10. The process of claim 4, further including depositing a second mask on said structures, and thermally oxidizing a selected portion of said structure through said mask.

11. The process of claim 1, wherein said substrate is alternately etched and passivated to produce a high aspect ratio structure.

12. A microelectromechanical structure comprising:  
a substrate having a cavity formed by etching through a single mask a two-level suspended structure in said substrate, the structure including:  
a first level incorporating a first clamp stage suspended in said substrate and movable by a first set of actuators;  
a second level incorporating a second clamp stage suspended in said substrate and movable independently of said first stage by a second set of actuators, said first and second levels being substantially identical and vertically self-aligned, said first and second sets of actuators being operable in opposite directions to shift one of said first and second clamp stages with respect to the other.